

Application No. 10/724,251

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Amendments to the Claims

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims

1. (currently amended) A method to decrease emission of mercury, comprising:

selecting a factor from to control a combustion process to generate a flue gas comprising fly ash with enhanced in situ-formed unburned carbon, wherein the factor is selected from the group consisting of reburning fuel, flue gas temperature, OFA injection, coal particle size, LNB flow, LNB design, combustion zone air, stoichiometric ratio of fuel, fuel/air mixing in a primary combustion zone and fuel/air mixing in a secondary combustion zone;

controlling the combustion process according to a the factor to produce the flue gas comprising fly ash with enhanced unburned carbon and to vaporize mercury; [and]

allowing the flue gas to cool to collect fly ash with enhanced unburned carbon with absorbed mercury;

passing the fly ash with enhanced unburned carbon with absorbed mercury through an ash burnout unit to remove carbon from the fly ash and to produce a mercury-containing exhaust gas; and

passing the mercury-containing exhaust gas through a mercury capture reactor to capture the mercury.

2. (original) The method of claim 1, comprising controlling the combustion process to produce a fly ash containing about 1 to about 30 weight percent carbon.

3. (original) The method of claim 1, comprising controlling the combustion process to produce a fly ash containing 3 to 20 weight percent carbon.

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4. (original) The method of claim 1, controlling the combustion process to produce a fly ash containing 5 to 15 weight percent carbon.

5. (original) The method of claim 1, comprising allowing the flue gas to cool to a temperature below 450° F.

6. (original) The method of claim 1, comprising allowing the flue gas to cool to a temperature below 400° F.

7. (original) The method of claim 1, comprising allowing the flue gas to cool to a temperature below 350° F.

8. (previously presented) The method of claim 1, further comprising removing NO_x from the flue gas, wherein the process to remove NO_x from the flue gas comprises forming fuel-lean and fuel-rich zones by a fuel staging process or an air staging process.

9. (original) The method of claim 1, further comprising removing NO_x from the flue gas.

10. (original) The method of claim 1, further comprising removing NO_x from the flue gas by a low NO_x combustion technology.

11. (original) The method of claim 1, further comprising removing NO_x from the flue gas by a technology selected from low NO_x burning, reburning, air staging, fuel-lean reburning and overfire air injection.

12. (original) The method of claim 1, further comprising removing NO_x from the flue gas by forming a fuel-lean zone and a fuel-rich zone by injection of solid fuel into a post combustion zone.

13. (original) The method of claim 1, wherein the flue gas is generated from combustion of solid fuel.

14. (original) The method of claim 1, wherein the flue gas is generated from combustion of a solid fuel selected from coal, biomass, waste product and combinations thereof.

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15. (original) The method of claim 1, comprising selecting a factor from the group consisting of amount of reburning fuel, flue gas temperature and OFA injection.

16. (original) The method of claim 1, comprising selecting a factor from the group consisting of coal type and particle size.

17. (original) The method of claim 1, comprising selecting a factor from the group consisting of LNB flow, LNB design, combustion zone air, stoichiometric ratio of fuel, fuel/air mixing in a primary combustion zone or fuel/air mixing in a secondary combustion zone.

18. (canceled)

19. (canceled)

20. (canceled)

21. (canceled)

22. (canceled)

23. (canceled)

24. (canceled)

25. (canceled)

26. (canceled)

27. (previously presented) The method of claim 1, conducted without activated carbon injection.

28. (previously presented) A method of operating a combustion furnace to decrease emission of mercury, comprising:

forming a fly ash with enhanced unburned carbon and forming vaporized mercury by (1) limiting an amount of air to the combustion furnace during combustion or by (2)

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fuel staging;

allowing the flue gas to cool to a lower temperature to collect fly ash comprising enhanced unburned carbon with absorbed mercury;

passing the fly ash with enhanced unburned carbon with absorbed mercury through an ash burnout unit to remove carbon from the fly ash and to produce a mercury-containing exhaust gas; and

passing the mercury-containing exhaust gas through a collection unit to capture the mercury.

29. .(currently amended) The method of claim 28, comprising forming the fly ash with enhanced unburned carbon by fuel staging comprising firing the furnace in a main burner in the combustion zone ~~in the presence of unlimited air~~ and injecting additional fuel for reburning in a fuel rich subsequent combustion zone.

30. .(currently amended) The method of claim 28, comprising forming the fly ash with enhanced unburned carbon by fuel staging comprising: firing the furnace in a main burner in the combustion zone ~~in the presence of unlimited air~~; injecting additional fuel for reburning in a fuel rich subsequent combustion zone; and subsequently applying overfire air to burn out remaining combustibles.

31. .(currently amended) The method of claim 28, comprising forming the fly ash with enhanced unburned carbon by fuel staging comprising: firing the furnace in a main burner in the combustion zone ~~in the presence of unlimited air~~; injecting additional fuel for reburning in a fuel rich subsequent combustion zone; subsequently applying overfire air to burn out remaining combustibles; and collecting the fly ash by filtering an overfire stream at a reduced temperature.

32. .(currently amended) The method of claim 28, comprising forming the fly ash with enhanced unburned carbon by fuel staging comprising firing the furnace in a main burner in the combustion zone ~~in the presence of unlimited air~~; and injecting additional fuel for reburning in a fuel rich subsequent combustion zone; wherein the

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additional fuel injection is controlled to provide a reduced reburning temperature between ~~2500 °F to 2000 °F~~ 2000 °F to 2500 °F.

33. (currently amended) The method of claim 28, comprising forming the fly ash with enhanced unburned carbon by fuel staging comprising firing the furnace in a main burner in the combustion zone ~~in the presence of unlimited air~~; and injecting additional fuel for reburning in a fuel rich subsequent combustion zone; wherein the additional fuel injection is controlled to provide a reduced reburning temperature between ~~2500 °F to 2000 °F~~ 2000 °F to 2500 °F to provide an enhanced carbon in fly ash content between 8% and 14%.

34. (currently amended) The method of claim 28, comprising forming the fly ash with enhanced unburned carbon by fuel staging comprising firing the furnace in a main burner in the combustion zone ~~in the presence of unlimited air~~; and injecting additional fuel for reburning in a fuel rich subsequent combustion zone; wherein the additional fuel injection is controlled to provide combustion at a reduced temperature in a range between 20% and 30% of the combustion zone temperature.

35. (previously presented) A method of increasing mercury removal from a combustion zone without the addition of activated carbon from an outside source, comprising increasing percentage of enhanced carbon in the combustion zone fly ash to capture an increased amount of mercury and recovering the mercury from the fly ash.

36. (previously presented) The method of claim 35, comprising increasing the percentage of enhanced carbon by combusting a feed fuel selected to provide said increased percentage.

37. (previously presented) The method of claim 35, comprising increasing the percentage of enhanced carbon by reburning in a fuel rich zone subsequent to an initial combustion zone; wherein additional fuel injection in the fuel rich zone is controlled to provide combustion at a reduced temperature from the temperature in the initial combustion zone.

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38. (previously presented) The method of claim 35, comprising increasing the percentage of enhanced carbon by reducing amount of air to the combustion furnace during combustion to increase loss on ignition (LOI) from 5 to 15%.

39. (previously presented) The method of claim 35, comprising increasing the percentage of enhanced carbon by identifying a fuel that provides increased loss on ignition (LOI) and using the fuel for combustion in said combustion zone.

40. (previously presented) The method of claim 35, comprising increasing the percentage of enhanced carbon by selecting a fuel that provides increased loss on ignition (LOI) and using the fuel for combustion in said combustion zone.

41. (previously presented) The method of claim 35, comprising increasing mercury removal from the combustion zone by at least greater than 0% to about 90% by increasing percentage of enhanced carbon in the combustion zone fly ash from at least greater than 0% up to about 15%.